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PORTABLE TELEPHONE SET

BACKGROUND OF THE INVENTION

Field of the Invention

5   The present invention relates to a portable telephone set, and more particularly to a technique of rewriting part of program data of a main memory of a portable telephone set to correct bugs of software.

Description of the Related Art

10   In recent years, the number of subscribers of portable telephone sets has increased and is increasing suddenly, and also the manufactured number of portable telephone sets has been and is increasing similarly. Portable telephone sets not only have mere telephone functions but also begin to have

15   functions as an information terminal. In order to implement functions as an information terminal, development not only of hardware but also of software has significant weight. From such significance of software, a bug upon shipment of portable telephone sets in most cases gives a critical blow to sales

20   of the portable telephone sets.

        Conventionally, if a bug of software occurs with a portable telephone set, then when the bug is found out and therefore the software must be corrected, data must be rewritten over the entire area of a memory (ROM) of the portable telephone

25   set from a descriptive configuration of the software. Accordingly, in order to rewrite the software for portable

telephone sets that have been placed on the market once, a countermeasure of voluntary recovery by the maker is taken. However, much time and labor are required for such voluntary recovery. Therefore, it is demanded to provide a portable telephone set whose software can be rewritten by a user in order to eliminate such voluntary recovery.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a portable telephone set wherein a countermeasure can be taken against a bug of software by a user without the necessity for voluntary recovery by a maker.

In order to attain the object described above, according to the present invention, there is provided a portable telephone set, comprising a read only memory in which program data are stored, a volatile memory for backing up the program data, and means operable when the portable telephone set is in a mode in which rewriting of the read only memory is allowed for writing part or all of the program data backed up in the volatile memory replaccably into the read only memory.

Preferably, the program data stored in the read only memory are stored in a program arrangement in accordance with an arrangement of memory blocks of the read only memory and can be rewritten in a unit of a block.

With the portable telephone set, a user can take a countermeasure against a bug of the software even if a maker

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does not perform voluntary recovery, and modification to the software can be performed readily in a short time.

The above and other objects, features and advantages of the present invention will become apparent from the following
5 description and the appended claims, taken in conjunction with the accompanying drawings in which like parts or elements are denoted by like reference symbols.

BRIEF DESCRIPTION OF THE DRAWINGS

10 FIG. 1 is a diagrammatic view showing a configuration of a memory space of a portable telephone set to which the present invention is applied;

FIG. 2 is a flow chart illustrating a procedure of operation of the portable telephone set; and

15 FIG. 3 is a schematic illustration illustrating a manner of use of the portable telephone set.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, there is illustrated an example
20 of configuration of a memory space of a portable telephone set to which the present invention is applied. The memory space includes a ROM section 1 and a RAM section 2. Data are stored in a unit of a block in the ROM section 1.

The ROM section 1 serves as a main program storage area
25 of the portable telephone set, and has a storage portion of a large capacity but operates in a comparatively long access

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cycle (read/write cycle). A nonvolatile memory such as a flash
memory whose storage data are not lost even if power supply
from primary and secondary cells is disconnected is used for
the ROM section 1. In order to rewrite the ROM section 1, it

5　must be placed into a special mode called IPL mode.

The RAM section 2 is a program execution area of the
portable telephone set, and has a small storage area but operates
in a comparatively short access cycle. A volatile memory
(flash-ROM) whose storage data are not lost even if the primary

10　cell is disconnected but are lost if the secondary cell is
disconnected is used for the RAM section 2. The RAM section
2 thus requires continual rewriting from a CPU.

The portable telephone set is shipped after a program
is written into the memory space of the ROM section 1. Upon

15　execution of the program, it is partly copied from the ROM section
1 into the RAM section 2. This is because it is intended to
execute the program as fast as possible. It is to be noted
here that, since the area of the RAM section 2 in the portable
telephone set is usually smaller than the area of the ROM section

20　1, all data of the ROM section 1 cannot be placed into the RAM
section 2. However, the software can be modified by arranging
the program in accordance with the arrangement of internal blocks
of the ROM section 1 and rewriting only a block of a modified
portion of the program from the RAM section 2 into the ROM section

25　1.

Now, operation of the portable telephone set is described

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with reference to a flow chart of FIG. 2. After power supply
to the portable telephone set is switched on, it checks the
ROM section 1 in step 201. If an error is detected, then the
processing advances to step 208, but if no error is detected,
5   then the processing advances to step 202. In step 202, it is
discriminated whether or not rewriting data for the ROM section
1 is stored in the RAM section 2. If no rewriting data for
the ROM section 1 is detected, then the processing advances
to step 214, in which a normal startup process is executed.

10   If rewriting data for the ROM section 1 is detected in
step 202, then the processing advances to step 203, in which
the state of a write flag is checked. If the write flag is
"1", then the processing advances to step 215, but if it is
"0" (default), then the processing advances to step 204, in
15   which the portable telephone set stores the rewriting data for
a ROM block into the RAM section 2 to back up the data. Thereafter,
the portable telephone set enters an IPL mode in step 205, and
writes the data backed up in the RAM section 2 into a corresponding
block of the ROM section 1 in step 206. Thereafter, the portable
20   telephone set sets the write flag to "1" in step 207, whereafter
the processing advances to step 218, in which the portable
telephone set executes a re-starting process.

On the other hand, if the processing advances from step
201 to step 208, the portable telephone set starts an error
25   process in step 208. Then in step 209, the portable telephone
set checks the write flag. If the write flag is "0", then the

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portable telephone set displays a warning of occurrence of an error in step 212 and then switches off the power supply in step 213. On the other hand, if the write flag is "1" in step 209, then the processing advances to step 210, in which the

5　portable telephone set writes the backed up ROM information into the corresponding block of the ROM section 1. Thereafter, the portable telephone set resets the write flag to "0" in step 211, whereafter the processing advances to step 218.

If the write flag is "1" in step 203 and the processing

10　advances from step 203 to step 215, then the portable telephone set erases the ROM backup block in the RAM section 2 in step 215 and then resets the write flag to "0" in step 216. Thereafter, the portable telephone set performs the normal startup process in step 217.

15　The IPL mode mentioned hereinabove signifies a mode in which writing into the ROM area is enabled. The portable telephone set usually starts its program from the address 0 (called boot block) of the ROM section 1 after power supply is switched on. The portable telephone set discriminates here

20　whether or not it should enter the IPL mode, and if it discriminates that it should perform a normal operation, then the address to be executed is jumped from the boot block to the top address of a block in which the normal operation program is placed. Therefore, the boot block is passed only once when

25　the power supply is made available, but is not accessed again during the normal operation.

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The write flag is used for discrimination of whether or not a modified program in the RAM section 2 has been written into the ROM section 1 already. As the write flag, a bit may be set in a region of the memory (RAM) or may be set in a register

5   for exclusive use in an IC.

Conventionally, software written in an area of a ROM section is continuously stacked in the memory area without being partitioned for different functions, and therefore, if it is tried to rewrite the contents of the ROM area, then it is necessary

10   to rewrite the entire area at a time because it cannot be partitioned for individual blocks of the ROM area. However, with the portable telephone set to which the present invention is applied, since the program is arranged in accordance with the arrangement of the internal blocks of the ROM section 1,

15   even the user can modify the software readily by storing modification data for the program in a unit of a block into the RAM section 2 and then rewriting the program data only of a block which includes the modified data from the RAM section 2 into the ROM section 1.

20   Consequently, even if a software bug of portable telephone sets is detected, the maker need not perform voluntary recovery of the portable telephone sets. Further, software optimized for each type of portable telephone sets can be updated successively. Furthermore, even if a portable telephone set

25   suffers from a software bug, it can fetch optimized software every time to improve the stability and operability thereof.

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Further, the memory (ROM) space can be used efficiently. In particular, when a user purchases a portable telephone set, the user can exclude (or erase) an unnecessary function within a range within which the software can be cut in a unit of a

5   block of the memory (ROM), but if the user wants later, the user can download the function to expand the functions of the portable telephone set. Accordingly, the memory space can be customized for each user. It is estimated that this is very effective when a program for functions of a portable telephone

10   set is described entirely using the JAVA in the future. Different from the other program languages at present, the JAVA does not manage each handler (JAVA applet) with an absolute address. Accordingly, further subdivision than ever can be achieved with the JAVA. There is the possibility that

15   subdivision using program languages at present may not be anticipated very much from the characteristics of the languages (a link of each handler cannot be cut readily).

It is to be noted that a ROM area portion to be rewritten need not necessarily be in a unit of a block. Rewriting into

20   a ROM at present allows erasure in a unit of a block (several kbits) and writing in a unit of a word (16 bits). However, a future ROM may allow erasure/writing in smaller units.

FIG. 3 illustrates a manner of use of a portable telephone set to which the present invention is applied. Referring to

25   FIG. 3, the portable telephone set is generally denoted at 31 and is connected to a communication undertaker server 32 by

radio. Further, the portable telephone set 31 is connected to a personal computer 33 of the user by a cable.

A modified program for bug fixation can be read into a RAM of the portable telephone set 31 from the personal computer

5 33 or the like through an external interface of the portable telephone set 31. Or, such a modified program for bug fixation may be downloaded from a communication network through the communication undertaker server 32. Further, the RAM of the portable telephone set 31 can be used not only for bug fixation

10 but also for expansion of functions of the portable telephone set 31.

It is to be noted that, since the user manages the memory area that has conventionally been prevented from being accessed by the user, the security and the safety must be assured. The

15 security is assured by an encryption process or the like between a data transmission section and the portable telephone set. Meanwhile, for rewriting of the memory, much attention is paid on the hardware side.

While a preferred embodiment of the present invention

20 has been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.